Test 1

Choose the correct answer for the questions (1) : (9) :

1 The isotopes of the same element are similar in the atomic number and different in the mass number, this fact contradicts the postulates of the atomic theory of ....

(a) Bohr.

(b) Rutherford.

(c) Dalton.

(d) Thomson.

2 All the following are deflected by the effect of the charged plates, except ....

(a) hydrogen atoms.

(b) cathode rays.

(c) alpha particles.

(d) protons.

3 Which of the following represents Rutherford's experiment ?

(a) When a beam of beta particles falls on a gold sheet, it is absorbed.

(b) When a beam of gamma rays falls on a gold sheet, it liberates electrons.

(c) When a beam of helium atoms falls on a gold sheet, it is deflected.

(d) When a beam of helium nuclei falls on a gold sheet, it is deflected.

4 The visible spectrum of hydrogen atom shows ....

(a) the presence of sublevels in each principal level.

(b) the presence of definite energy levels.

(c) the possibility of the emission of a quantum from the orbital of *1s*

(d) the presence of different isotopes of hydrogen atom.

5 **How many quanta are released when the electron in hydrogen atom jumps from (n = 4) to (n = 1) ?**

ⓐ 6
ⓑ 3
ⓒ 2
ⓓ 1

6 **What happens to the spaces between energy levels on moving from (n = 1) to (n = 7) ?**

ⓐ Decrease by increasing (n).
ⓑ Do not change.
ⓒ Increase by increasing (n).
ⓓ Change irregularly.

7 **The concept of the atom as the smallest unit of matter was adopted by** ....

ⓐ Democritus and Aristotle.
ⓑ Boyle and Aristotle.
ⓒ Democritus and Thomson.
ⓓ Bohr and Berzelius.

8 **Bohr's model could explain successfully the spectrum of** ....

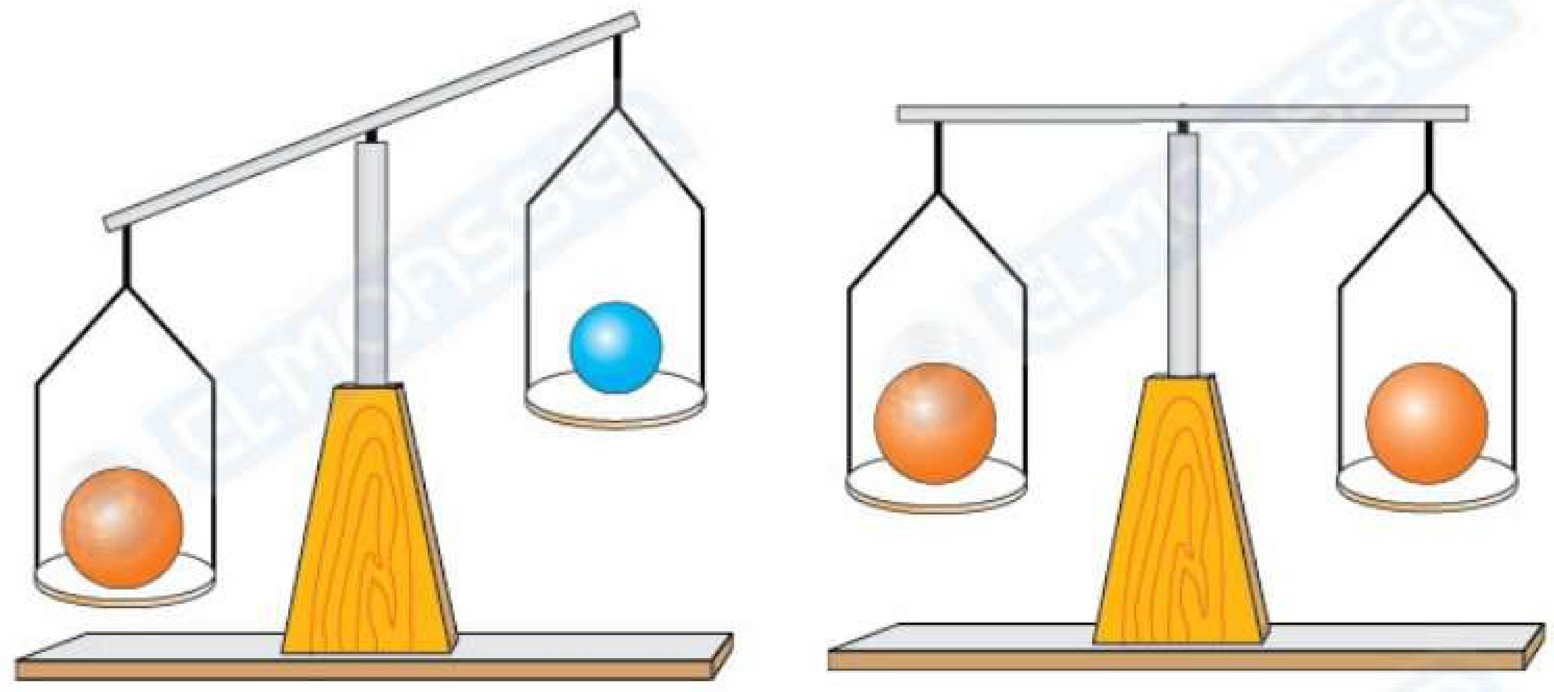
ⓐ the multi-electron atoms.
ⓑ helium.
ⓒ any atom or ion containing only one electron.
ⓓ hydrogen molecule.

9 **Each of the following can be confirmed undoubtedly, except** ....

ⓐ the number of energy levels which are occupied by electrons in $_{12}Mg$ atom.
ⓑ the number of orbitals which are occupied by unpaired electrons in $_{26}Fe$ atom.
ⓒ the position and the speed of the electron in hydrogen atom at a certain moment.
ⓓ the difference of the properties of the cathode rays with the difference of the type of the substance of the cathode.

Essay questions :

10 **The opposite figure represents one of the postulates of an atomic theory that you have studied :**



(1) **What** is the name of this theory ?

....

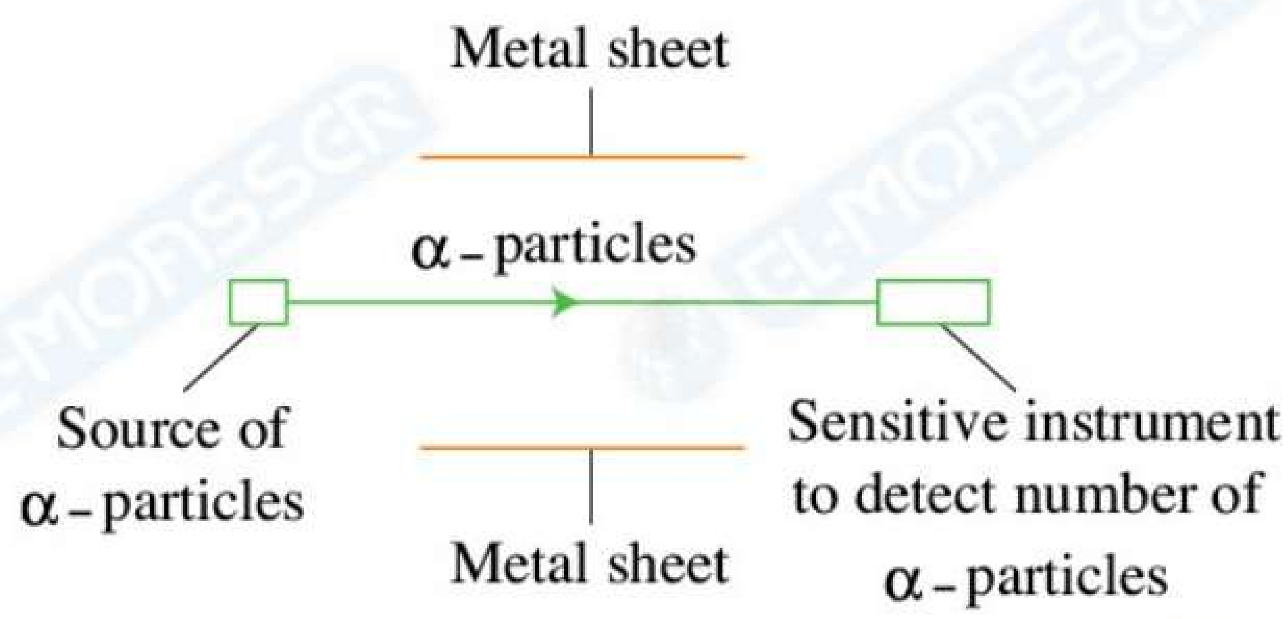
....

(2) **State** the postulate represented in the figure.

....

....

11 **The opposite figure represents the path of a beam of α-particles between two metal sheets in vacuum conditions :**



(1) **Illustrate** on the figure the path of the beam of α-particles if the upper metal sheet becomes negatively charged and the lower metal sheet becomes positively charged.

(2) **Predict** what will happen to the reading of the sensitive instrument after charging the two metal sheets with different charges.

....

12 **State a similarity and a difference** between Thomson's model of atom and the modern atomic theory

....

Test 2

Choose the correct answer for the questions (1) : (9) :

1 **Which of the following is a correct application of one of the postulates of Dalton's theory ?**

ⓐ The atoms of a sample of iron are not necessarily similar.
ⓑ Hydrogen substance is formed of very minute particles called ions.
ⓒ Water is formed from hydrogen and oxygen elements in a constant weight ratio.
ⓓ Carbon and hydrogen elements combine in different weight ratios to form many compounds.

2 **On the absence of magnetic field or electric field which affects the tube of the cathode rays, the rays ....**

ⓐ are not formed.
ⓑ move in straight lines.
ⓒ become positively charged.
ⓓ do not glow.

3 **All the following are among the conclusions of Rutherford's experiment, except that ....**

ⓐ the atom contains vast space.
ⓑ the nucleus is so much smaller in size than the atom.
ⓒ most of the atomic mass is concentrated in the nucleus.
ⓓ the electrons revolve around the atom in definite orbitals.

4 **The line spectrum differs from an element to another due to ....**

ⓐ the difference in the number of neutrons in each of them.
ⓑ the difference in the mass number of each of them.
ⓒ the difference in the electronic configuration of each of them.
ⓓ the difference in the number of valence electrons in each of them.

5 **The following are some postulates of the theories which explain the atomic structure :**

- **Theory (A) : The electronic shells surround the nucleus which is in the center of the atom.**
- **Theory (B) : The atom is invisible solid sphere.**
- **Theory (C) : The atom contains vast space.**

What is the historical order of these three theories ?

ⓐ A ⟶ B ⟶ C
ⓑ B ⟶ C ⟶ A
ⓒ A ⟶ C ⟶ B
ⓓ B ⟶ A ⟶ C

6 **Bohr's atomic model can be applied to** ....

(a) Na^{10+} ion. (b) He atom. (c) Be^{2+} ion. (d) C^{6+} ion.

7 **Which of the following supports the dual nature of the electrons ?**

(a) The emission spectrum of hydrogen atom.
(b) The deflection of some α-particles on collision with gold foil.
(c) The penetration of some α-particles on collision with gold foil.
(d) The properties of the cathode rays.

8 **All the following statements are correct, except** ....

(a) the wave mechanical theory of the atom is currently the accepted atomic model.
(b) the electron moves away from the nucleus upon being excited.
(c) according to Dalton's atomic model, the elements can combine chemically to form the compounds.
(d) Rutherford's experiment is the first to discover the presence of the negatively charged electrons in the atom.

9 **Understanding the movement of the electrons in the atom is based on all the following, except** ....

(a) Rutherford's experiment which proved the presence of the nucleus.
(b) Thomson's atomic model.
(c) Bohr's model of atom which is based on hydrogen atom.
(d) Schrödinger's equation which introduced the concept of the orbital.

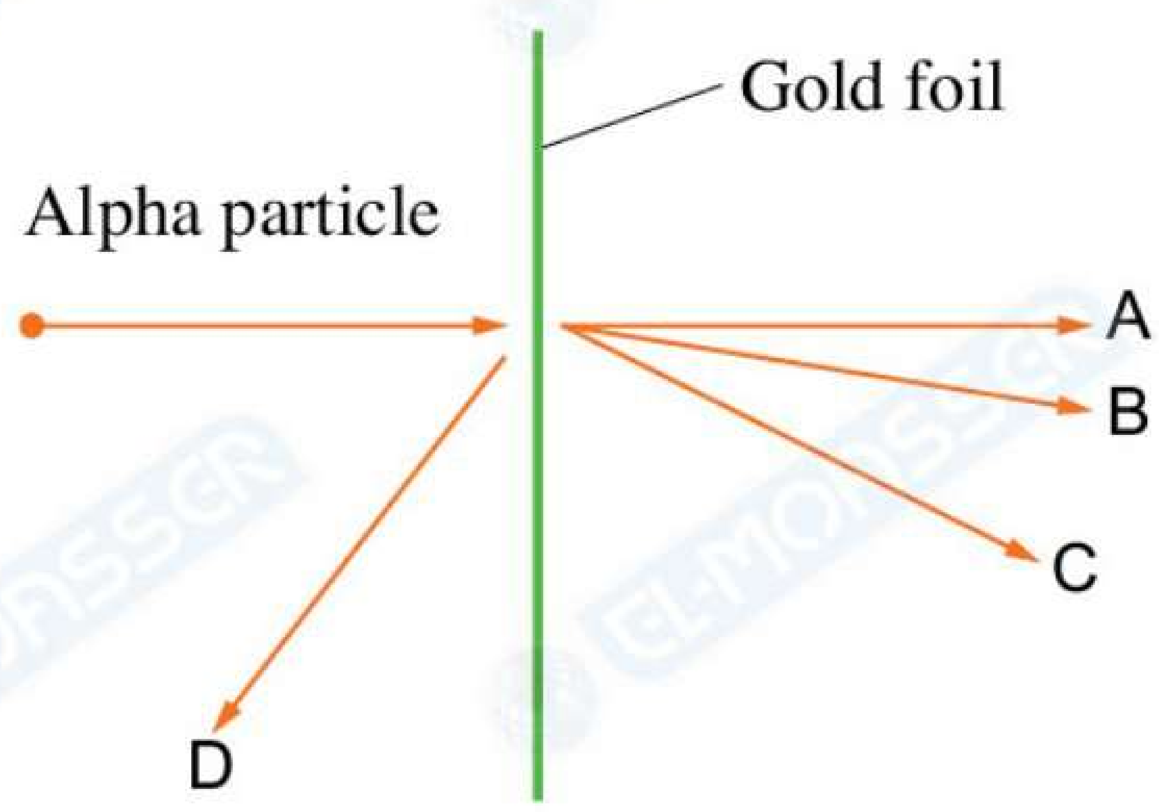
Essay questions :

10 **The opposite figure shows the different paths of alpha particles, when a beam of them hits a foil of gold :**

(1) **Which** of the shown letters represents the path of one in every 20000 alpha particles ?

....

....



(2) **What** can be deduced from this observation ?

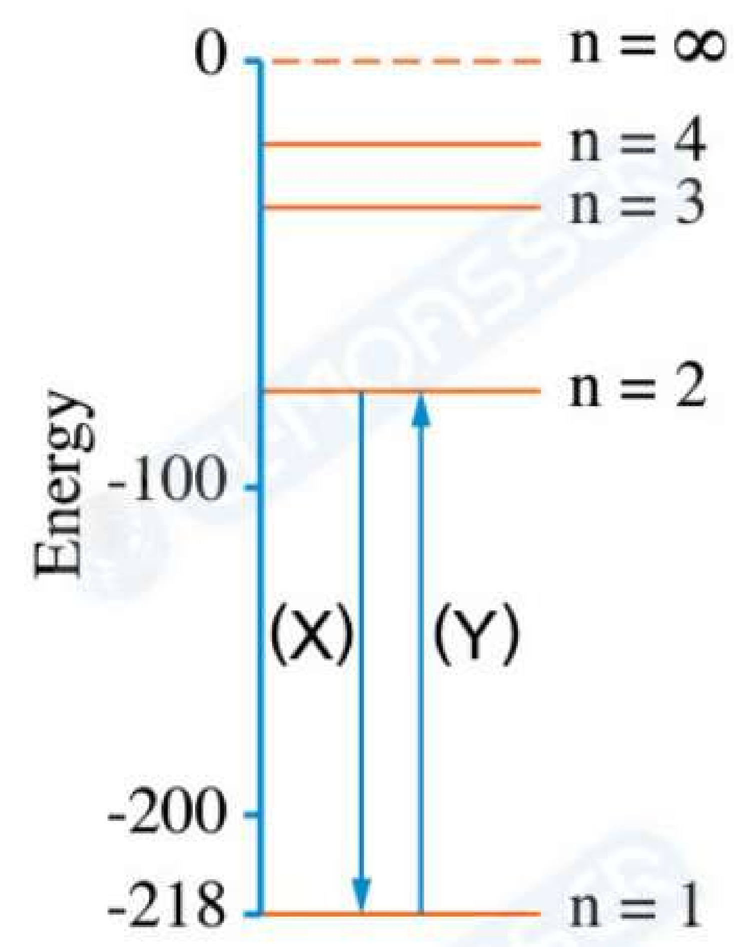
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11 **In the opposite figure :**

Which of the two processes (X) and (Y) requires losing energy ?

What is the scientific term of this amount of energy ?



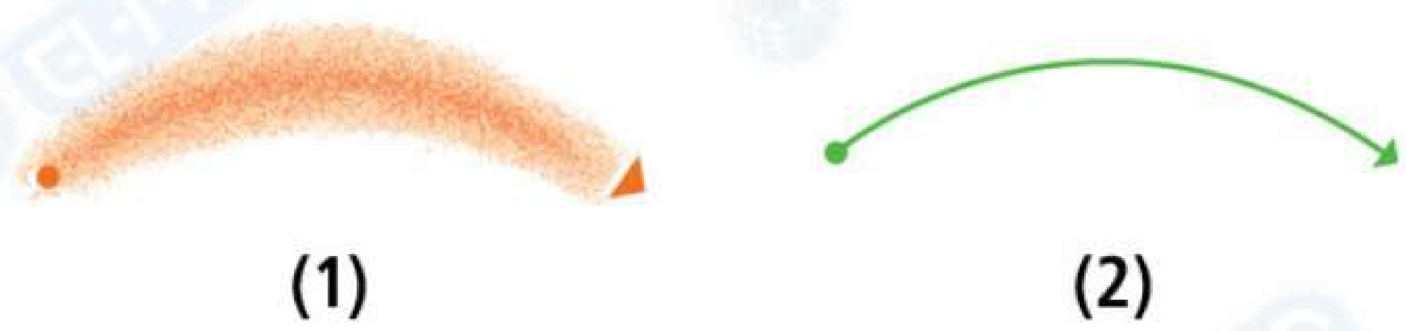
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12 **The opposite figures show** two different perceptions of the movement of the electrons around the nucleus.

Which of them assumes the possibility of determining the position of the electron precisely ?

To whom this assumption is attributed ?



....

Answers of Test 1

1 (c)   2 (a)   3 (d)

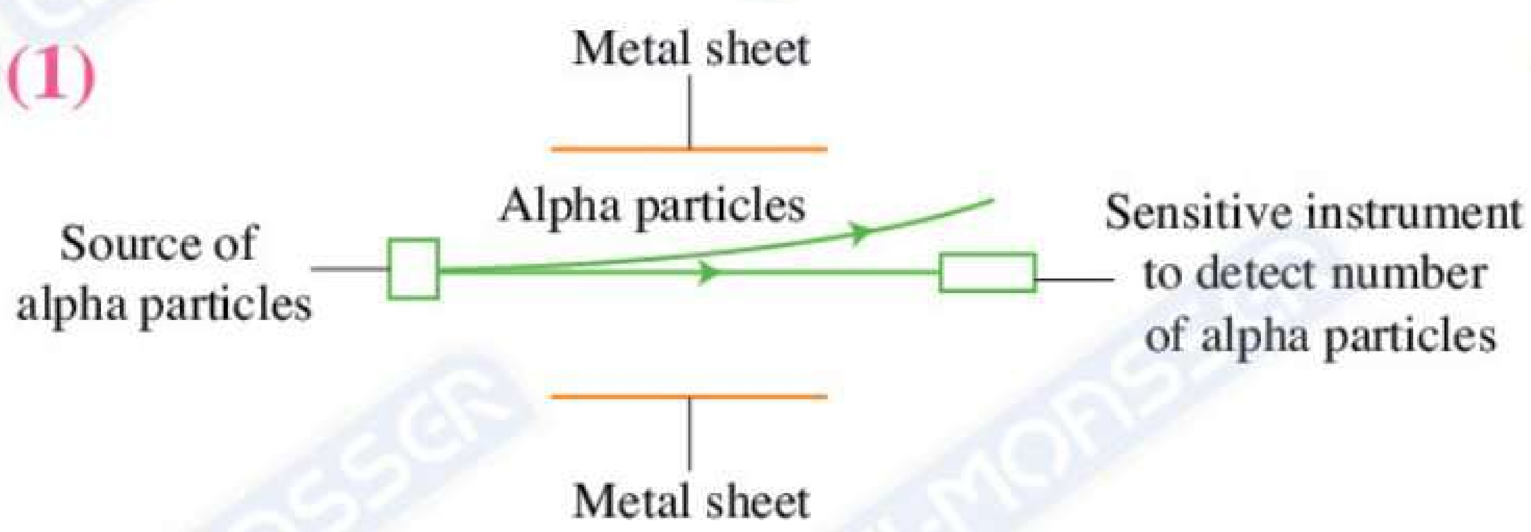
4 (b)   5 (d)   6 (a)

7 (c)   8 (c)   9 (c)

10 (1) Dalton's theory.

(2) Masses of the atoms of the same element are similar, but they differ from an element to another.

11 (1)



(2) The reading of the sensitive instrument decreases.

12 • **The similarity :** The atom is electrically neutral.

• **The difference :** The atom is solid according to Thomson's model, but it has a vast space according to the modern atomic theory (or any other correct answer).

Answers of Test 2

1 (c)   2 (b)   3 (d)

4 (c)   5 (b)   6 (a)

7 (d)   8 (d)   9 (b)

10 * The process (X).

* The quantum.

11 (1) (B) and (C).

(2) The charge of the nucleus is similar to the charge of positive alpha particles, so it repels them on approaching to it.

12 Figure (2) / Bohr.

Test 1 on the First month

Giza Governorate | Haram Educational zone

Choose the correct answer for the questions 1 : 9

1 **Which of the following represents the rays that are produced from the discharge tube under high voltage ?**

ⓐ They are deflected away from negative plate.
ⓑ They are not deflected by the magnetic field.
ⓒ They are positively charged.
ⓓ They are striking the cathode.

2 **Which of the following transitions of the electron of hydrogen atom results in the emission of visible line spectrum with the highest frequency ?**

ⓐ (n = 6) ⟶ (n = 2)
ⓑ (n = 3) ⟶ (n = 4)
ⓒ (n = 5) ⟶ (n = 1)
ⓓ (n = 3) ⟶ (n = 2)

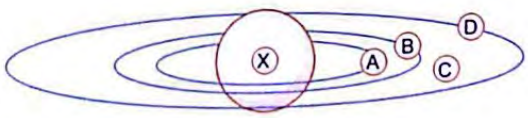
3 **In Rutherford's experiment, very small fraction of the positively charged particles ....**

ⓐ were slightly deflected as they passed through the metal.
ⓑ passed straight through the metal.
ⓒ were reflected back from the metal.
ⓓ combined with the metal.

4 **Which of the following facts doesn't match Dalton's atomic theory ?**

ⓐ Any matter is made up of small particles which are called atoms.
ⓑ Atoms are not divided in chemical reactions.
ⓒ Atoms of the same element are chemically alike.
ⓓ All atoms of same element have the same mass.

5 **In the opposite figure :**
What is the position in which is impossible for the electron to be present (according to Bohr's theory) ?



ⓐ (A)
ⓑ (B)
ⓒ (C)
ⓓ (D)

6 **The modern atomic theory agrees with Rutherford's atomic model on ....**

ⓐ the system in which the electrons revolve around the nucleus.

ⓑ that the electron has dual nature.

ⓒ the impossibility of determination both the speed and the location of the electron together precisely.

ⓓ that the atom is not uniformly dense.

7 **The scientist who presumed that it is most probable to find the electrons in the orbitals is ....**

ⓐ Bohr. ⓑ Rutherford.

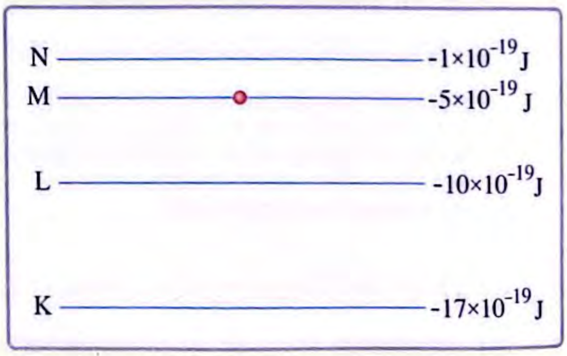
ⓒ Thomson. ⓓ Schrödinger.

8 **The electrons of an atom have the lowest possible energies, when the atom is in ....**

ⓐ excited state. ⓑ inert state.

ⓒ ground state. ⓓ radiation-emitting state.

9 **In the opposite figure, if an electron in the energy level M in a hypothetical atom acquires an amount of energy equals 4×10^{-19} J, then it ....**



ⓐ transfers to the energy level L

ⓑ transfers to the energy level K

ⓒ transfers to the energy level N

ⓓ remains in the energy level M

Answer the essay questions 10 : 12

10 **Discuss the role of** the scientist Schrödinger in explaining the atomic structure.

....

....

....

11 **Mention the scientific explanation** electrons travel around the nucleus in special orbits at a tremendous speed despite the mutual attraction between them and the nucleus.

....

....

....

12 **Explain briefly** the role of zinc sulphide in Rutherford's gold foil experiment.

....

....

Test 2 on the First month

Dakahlia Governorate | Educational zone

Choose the correct answer for the questions 1 : 9

1. To get visible spectrum of the hydrogen atom of an electron excited to the third energy level (M), this electron must ....
   - (a) lose a quantum lower than that gained.
   - (b) lose a quantum which is gained.
   - (c) gain a quantum.
   - (d) lose a quantum higher than that gained.

2. By applying the wave equation to the last electron in sodium atom $_{11}Na$ it's found that ....
   - (a) it is possible to determine its position accurately in the energy level M
   - (b) it moves nearer and farther from the nucleus in the energy level M
   - (c) its energy is less than that energy of the electrons in the energy level L
   - (d) it transfers to the energy level L by losing a quantum of energy.

3. Each atom of hydrogen and helium contains one energy level. Which of the following choices is correct ?
   - (a) They are different in the atomic emission spectrum.
   - (b) They are equal in the number of electrons in each of them.
   - (c) They are different in the principal quantum number.
   - (d) They are similar in the atomic emission spectrum.

4. What is the drawback of Bohr's model which was modified by the modern atomic theory ?
   - (a) The electron has wave nature only.
   - (b) The electron is a negative charged particle only.
   - (c) The electron orbits the nucleus in certain orbitals.
   - (d) The electron has dual nature.

5. The study of atomic spectra is considered the key by which we knew ....
   - (a) that the electrons are negatively charged.
   - (b) that the atom has a nucleus.
   - (c) the energy levels in the atom.
   - (d) all the previous.

6 **Which of the following transfers of the electron in hydrogen atom produces a photon with the lowest wavelength ?**

ⓐ (n = 3) ⟶ (n = 2)

ⓑ (n = 4) ⟶ (n = 3)

ⓒ (n = 4) ⟶ (n = 1)

ⓓ (n = 3) ⟶ (n = 1)

7 **The experiment which showed the existence of very fine negatively charged particles in any atom is ....**

ⓐ the cathode-ray tube experiment, explained by Dalton.

ⓑ the gold foil experiment, explained by Thomson.

ⓒ the gold foil experiment, explained by Rutherford.

ⓓ the cathode-ray tube experiment, explained by Thomson.

8 **The opposite figures describe two different perceptions for the movement of electrons around the nucleus.**
What is the theory which explained each of them ?

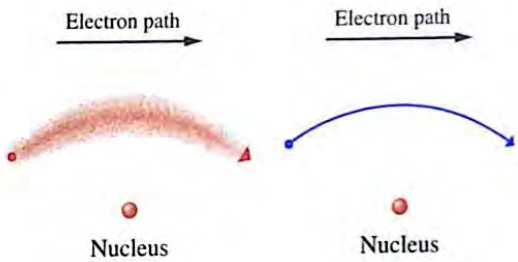


Figure (X) **Figure (Y)**

ⓐ X : Modern atomic theory,
Y : Rutherford's atomic theory.

ⓑ X : Bohr's atomic theory,
Y : Modern atomic theory.

ⓒ X : Modern atomic theory, Y : Bohr's atomic theory.

ⓓ X : Bohr's atomic theory, Y : Rutherford's atomic theory.

9 **Which of the following does not match Dalton's atomic model ?**

ⓐ Atoms of the same element are identical.

ⓑ Atoms can be divided into smaller parts.

ⓒ Atoms of different elements can chemically combine to form compounds.

ⓓ Atoms of an element are impossible to transform into atoms of another element.

Answer the essay questions (10) : (12)

(10) **Illustrate** two of the drawbacks of Bohr's atomic model.

....

....

....

(11) **Compare between** the orbit according to Bohr's atomic model **and** the orbital according to the modern atomic theory.

....

....

....

(12) **Give reason** Rutherford deduced that most of the atom is space.

....

....

Test 3 on the First month

El Gharbia Governorate | Educational zone

Choose the correct answer for the questions (1) : (9)

1 **Dalton and Thomson agreed on that carbon atom ....**

(a) has no spaces within it.
(b) is electrically neutral.
(c) contains negative electrons.
(d) is homogeneous sphere.

2 **Which of the following are not deflected by the effect of the charged plates ?**

(a) Cathode rays.
(b) Alpha particles.
(c) Protons.
(d) Hydrogen atoms.

3 **According to Bohr's atomic model, to travel from the first level (K) to the fourth level (N), the electron ....**

(a) acquires a quantum.
(b) loses a quantum.
(c) acquires four quanta.
(d) loses four quanta.

4 **The visible line spectrum of hydrogen atom arises as a result of the return of the excited electron from higher energy levels to the level ....**

(a) K
(b) L
(c) M
(d) N

5 **If the difference in energy between energy level (K) and (L) is ΔE_1 then the difference in energy ΔE_2 between energy levels (O) and (P) is ....**

(a) higher than ΔE_1
(b) lower than ΔE_1
(c) equal to ΔE_1
(d) approximately ΔE_1

6 **The modern atomic theory agree with Rutherford's model on ....**

(a) that the atom is not solid.
(b) that the electrons have wave properties.
(c) that it's impossible to determine the speed and position of the electron together precisely.
(d) the pattern according to which the electrons orbit the nucleus.

7 **Which of the following cases is a gas that conducts electricity ?**

(a) Hydrogen gas at normal conditions.
(b) Neon gas upon its decomposition.
(c) Argon gas under high pressure and low voltage.
(d) Chlorine gas under low pressure and high voltage.

8 **The ratio of the number of hydrogen atoms to that of nitrogen atoms in ammonia molecule is 3 : 1, this is consistent with one of the postulates of ....**

ⓐ Thomson's theory. ⓑ Rutherford's theory.

ⓒ Bohr's theory. ⓓ Dalton's theory.

9 **What does happen to the spaces between energy levels on moving from (n = 1) to (n = 7) ?**

ⓐ Decrease by increasing (n).

ⓑ Don't change.

ⓒ Increase by increasing (n).

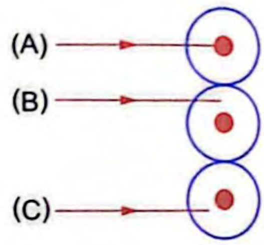
ⓓ Change irregularly.

Answer the essay questions 10 : 12

10 The opposite figure shows Rutherford's experiment.

Which of alpha particles (A, B or C) will flash at the same position before and after placing the gold foil ?

Explain your answer.



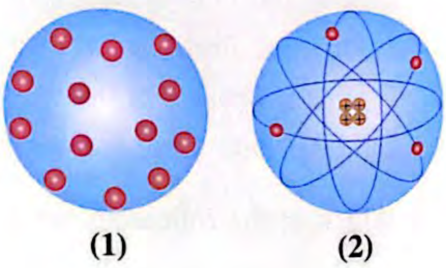
....

....

....

11 **The opposite figures represent two attempts to explain the atomic structure.**

What is the name of the theory that each figure represents ?



....

....

12 The two opposite figures represent two different perceptions for the movement of the electrons around the nucleus.



Figure (X)



Figure (Y)

(1) What is the name of scientist who suggested the perception which is illustrated in figure (Y) ?

....

....

(2) What is the scientific term that represents the region in which the electron can be found in the figure (X) ?

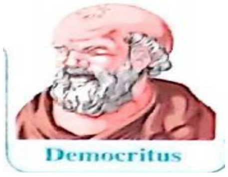
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Chapter one

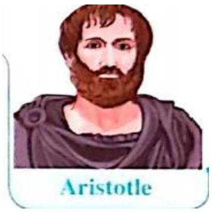
Structure of the atom

Atomic structure



1- Greek philosophers: (Democritus)

Any piece of matter can be divided into smaller parts and each part can be subdivided into smaller parts which can't be divided this part is called Atom.



2- Aristotle:

a-He refused the idea of Greek philosophers about the atom .

b- He supposed that all matters composed of 4 constituents which are (water, air , dust and fire and postulated that the cheap metals such as iron or copper can be changed into precious ones like gold by changing the percentage of four constituents.



3- Boyl (lrish 1661):

i-He refused the Aristotle concept.

ii-He was the 1st scientist to define the element as pure simple substance which can not be analysed into smple one by normal chemical methods.



4) Dulton s atom (Englsh 1803) :

He supposed thet :

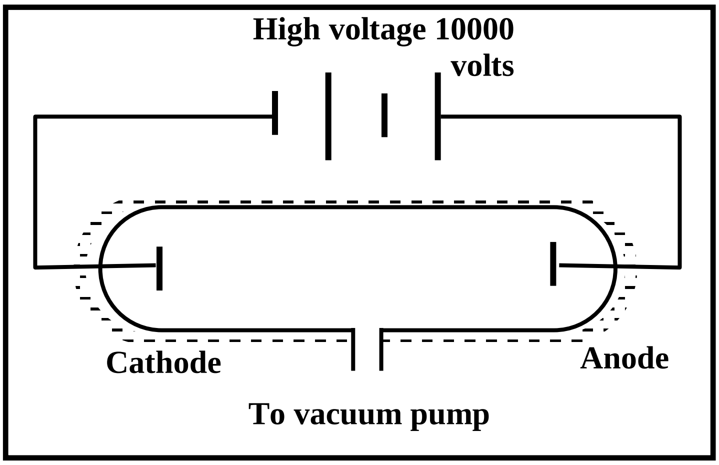
1- **The substance consists of very amall particles called atoms.**
2- **Every element consists of very small dense atoms which can t be divided.**
3- **Atoms f the same element are identical.**
4- **Atome of different are different.**

N.B **By the 19 th century**

Scientists had accepted the idea that elements consists of atoms but they knew very little about those atoms.

Cathode- ravs experiment

(discovery of the electron)



a- All gases under normal conditions of pressure and temp (76 cm. hg. 25c) don t conduct electricity .

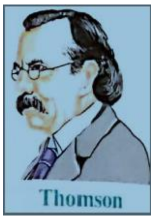
b- If a glass tube evacuated from the gas to decrease its pressure to reach 0.01.1 ------------- 0.001 m.mhg

The gas will conduct electric current.

c- If the potential difference between the tow poles increases up 10.000 Volts a Flow of invisble rays are emitted from the cathode causing glowing to the wall of tube behind the anode and called cathode ray .

Properties of cuthode rays

1) Consists of tiny particles have mass and velocity.
2) Transfers in straigh lines glowing the glass facing the cathode.
3) Have negatve charge.
4) Have a thermal effect.
5) Affected by electric and Magnetic field.
6) Cathode rays don t change by changing either cathode material or type of the gas which proves that cathode rays take part in the structure of all substances.

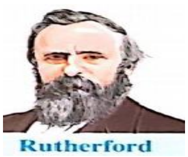


5 – Thomson s atom 1897 :

He conclude from the last experiment that

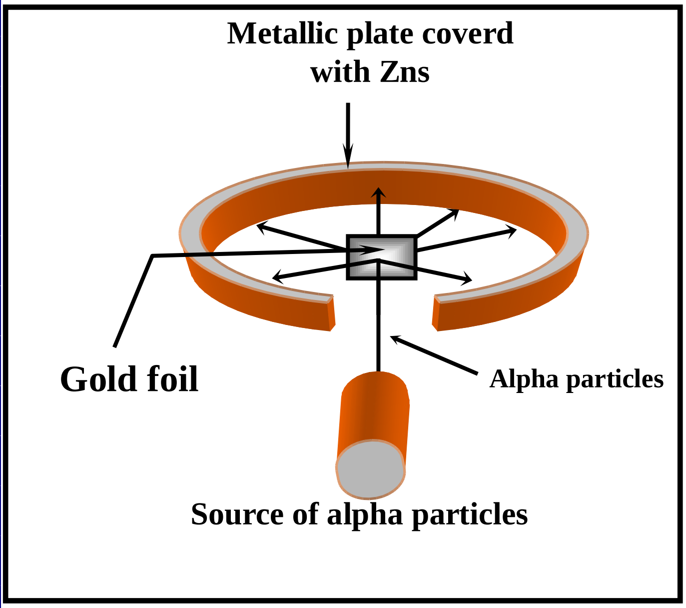
i- The atom is a homogenous sphere of positive electricity.

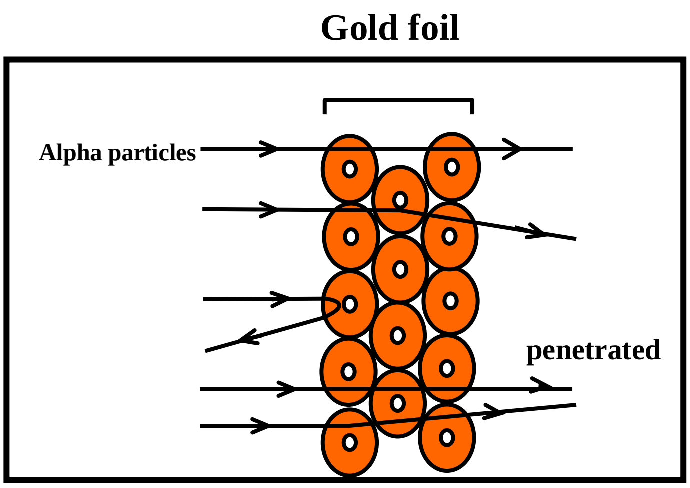
ii- Inside it there are negative electrons enough to make it electrically neutral.



Rutherford s experiment

In 1911 Geiger and Marsden performed a famous exp According to suggestion of Ruther ford by the followng apparatus.





1 – He allowed alpha particles to hit a mtallic plate lined with Zinc suphide (glows when hits with alpha rays)

2 – On placing a gold foil in the front of alpha rays he concluded the following from the following observation.

Observation	Result
1- Most of alpha particles appeared in the same position before putting gold foil.	1- Most of the atom is a space not solid as explained by Dalton and thomson.
2- A very small percentage of alpha particles reflected back to appears as flashes on other side of sheet.	2- The atom has very small part with very small volume but high density.
3- Some flashes appeared on the sides of 1^{st} site.	3- The dense part of the atom which concentrate in it most mass have same charge of alpha particle (+ve) which called nucleus of the atom.

Structure of the atom

Atomic No:

No of protons inside the nucleus or no of electrons inside the E. levels.

Mass No:

Sum of protons and neutrons inside the nucleus.

Isotopes:

Are different forms of atoms of the same element which have same atomic nos but different mass no.

Ex: hydrogen has 3 isotopes: ……….

Rutherford:

Rutherford was the 1st scientist who stated the concept of the atomic structure.

1-The Atom:

Although it has very small size but it has a complicated structure that resembles the solar system in which electrons revolve around the central nucleus in orbits as planets revolve around the sun.

2-The Nucleus:

Is much smaller than the atom. Located in the centre of the atom with (+ve) charge. There is a big space between the nucleus and orbits of electrons, so most of the atom is a space. Most mass of the atom is concentrated in the nucleus as mass of e is very small and can be neglected.

3-Electrons:

1-Have negligible mass compared to that of the nucleus.

2-No of electrons (-ve) equals no of ptotons (+ve) so the atom is electrically neutral.

3-Electrons revolve around the nucleus in a fixed orbit as electrons are affected by two forces equal in strength but in opposite direction, which are :

a- Force of attraction of the nucleus to electrons.

b- Centrifugal force due to velocity of electron around the nucleus.

Give reason: Electrons are not attracted to the nucleus.

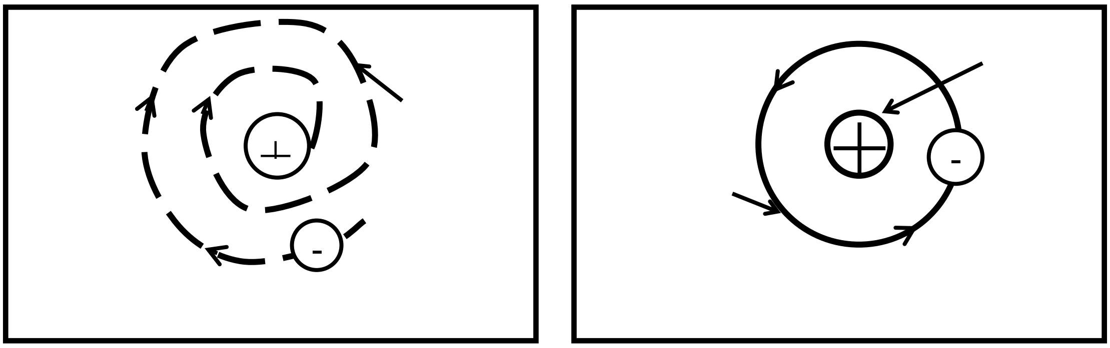
Explain: Structure of the atom in the view of rutherford.

Objections on Rutherford's atomic model (Maxwell's theory):

Rutherford's concept was contradicted by maxwell's theory (Which was based on laws of newton mechanics and concerned with the movement of relatively large bodies).

- **Which states that: " When an electrecally charged body moves in orbit, it will lose its energy gradually by emission of radiation causing gradual decrease in orbit radius".**

By applying this theory on electron movement in Rutherford's atom, we would expect that electrons are in a state of continuous emission of radiation, so the atomic radius will decrease and electrons move in a spiral orbit until they hit the nucleus.



Give reason: Contradiction between the classical mechanical laws and rutherford.

Bohr's Atomic Model

Bohr's postulates:

1- A positively charged nucleus exists in the center of the atom.
2- Atom is electrically neutral as no of p^+ s equals to no of e's.
3- Electrons revolve around the nucleus in orbits due to centrifugal and attraction forces.
4- Electrons orbit the nucleus in a rapid movement without gaining or losing energy.
5- Electrons orbit the nucleus only in a definite allowed energy levels, so they can't be found at intermediate distance.

6- Each electron in the atom has a definite amount of energy depending on the distance between is E.L and nucleus. This energy increases as its radius increases.

7- It was found that the maximum no of energy levels in the heaviest known atoms in their ground state (unexcited) is only seven (K, L, M, N, O, P, Q). Each level has energy expressed by a whole no called principle Q. No.

Ex: The 1st E. Level K its principle Q. no = 1
The 2nd E. level L its principle Q. no = 2

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- It is an atom that acquired an amount of energy (Q) sufficient to transfer its e's from their original E.L to higher ones.

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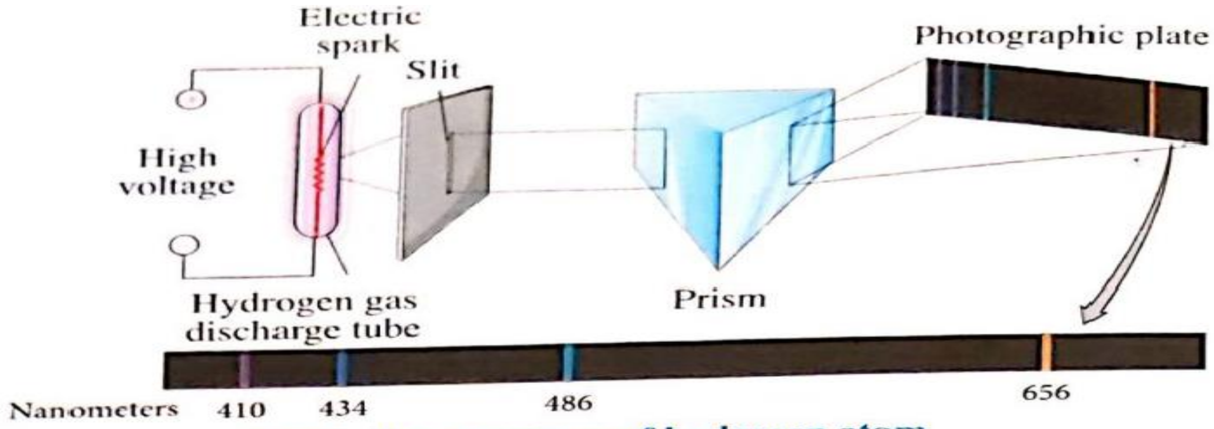
Bohr's Theory

The atomic spectrum

Studying and explaining the atomic spectrum was the key to he atomic structure in 1913 and deserved noble prize at 1922.

Atomic emission spectrum:

1 – By heating gases or vapours of substances to a high temperature (by heat or electricity) under low pressure it produces light.
2 – By using spectroscope we find that this light consists of a fixed number of coloured lines called line spectrum.



Visible line spectrum of hydrogen atom

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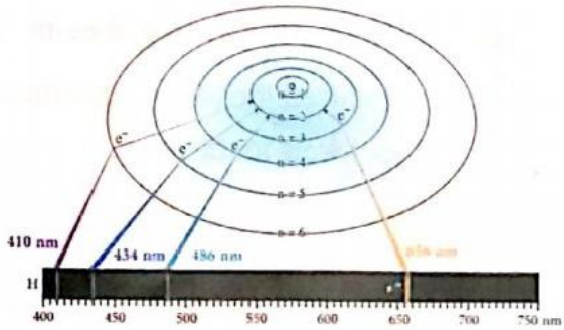
N.B:

Line spectrum of sun rays shows that composed of hydrogen and Helium.

For illustration only

The opposite figure which is representing the spectral line of the hydrogen atom doesn't represent the electron transferring from :

- The different energy levels to the first energy level, because the wavelength of the emitted ray from the excited electron is located in the invisible region of the ultraviolet rays.
- The seventh energy level to the second energy level, because the wavelength of the emitted ray from the excited electron is located in the invisible region of the infrared rays.



The visible spectral line of hydrogen atom consists of four colored lines.

The principles of Modern Atomic Theory:

1 – Dual nature of electron.

2 – The Heisenberg uncertainty principle.

3 – Finding the mathematical expression which describes the wave motion of electron, its shape and its energy.

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1 – The dual nature of the electron

The experimental data showed that the electron has a dual nature i.e

a) It is a material particle. b) It has wave properties.

* De Broglie principle:

Every moving body (such as electron or the nucleus of an atom or whole molecule)is associated with (accompanied by) a wave motion (or matter waves) which has some properties of light waves.

The matter wave motion differs from electromagnetic waves n ....

Matter Waves	Electromagnetic Wave
1- They are not separating from the moving body	1- They are separated from the moving body
2- Their speed is not equal to the speed of light	Their speed is equal to the speed of light

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It is practically impossible to determine both position and the velocity of the electron exactly (precisely) at the same time. We can only say that it is probably to a greater r lesser extent to locate the electron in this or in that place. This is to speak in terms of probability seems to be more precise.

3. The wave equation for motion of electron inside the atom:

(Schrodinger wave mechanics theory): He applied the ideas of Blanck, Einestein, De Broglie and Heisenberg so he shows that:

- ❖ It is possible to determine the allowed energy levels of the electron and define the region of space around the nucleus where it is most probable to find the electron in each energy level.
- ❖ The electronic motion around nucleus has a wave properties therefore the position to use the term electron cloud to describe any orbital.

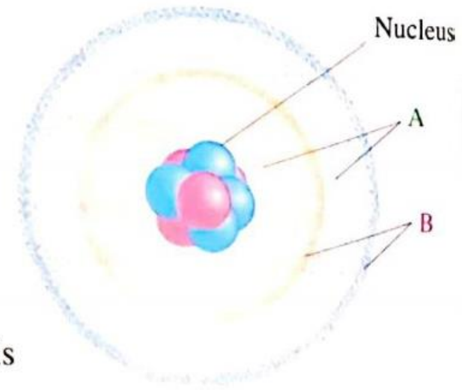
Electron Cloud: (used to describe any orbital)

"Area of space around the nucleus where there is a great probability for finding electrons in all direction and all positions."

Electron cloud

It is the region of space around the nucleus, in which the electron probable exists in all directions and distances (dimensions).

- There are regions inside the electron cloud in which probability of finding the electron increases, each of them is termed by "the orbital" (region B).

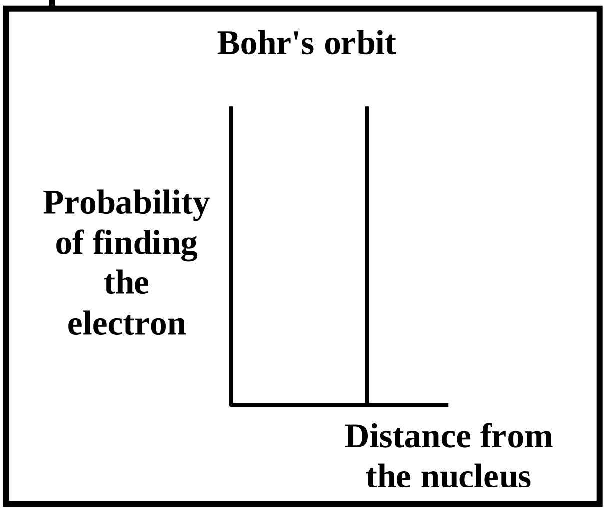
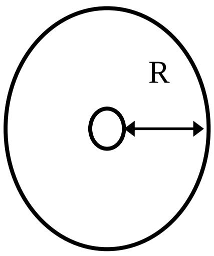
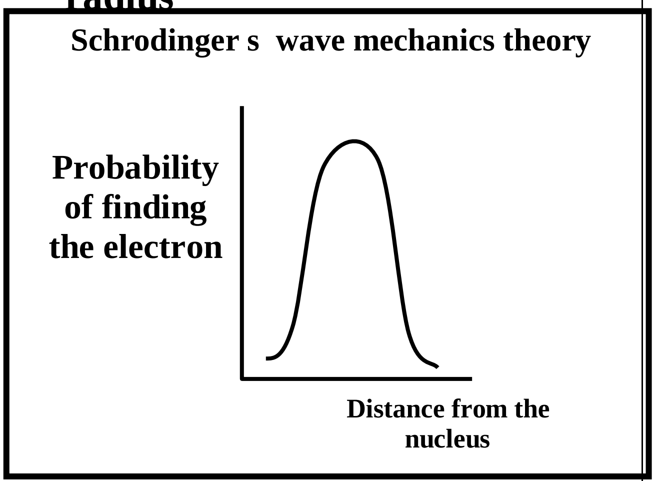
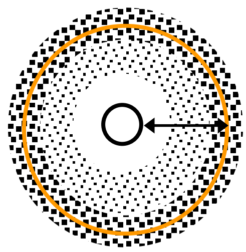


Electron cloud and orbital

Orbital

It is the region within the electron cloud of high probability of finding the electron.

❖ **The difference between the orbit and orbital concepts according to both Bohr and the wave mechanics theories:**

Bohr s theory	**Schrodinger s wave mechanics theory**
• It is a circular planer orbit with particular radii   	• It is an electron cloud used to describe any orbital • Electron cloud the regions of high density of dots represent the region of high probability of finding the (e) from which it is possible to define the atomic radius  

❖ **The mathematical solution of the Schrodinger equation introduced four numbers which are called quantum numbers.**

Chapter one

Structure of the atom
Atomic structure

1- Greek philosophers:
Any piece of matter can be divided into smaller parts and each part can be subdivided into smaller parts which can't be divided this part is called Atom.

2- Aristotle

A-He refused the idea of Greek philosophers about the atom.

b- He supposed that all matters composed of 4 constituents which are (water, air , dust and fire and postulated that the cheap metals such as iron or copper can be changed into precious ones like gold by changing the percentage of four constituents.

3- Boyl (Irish 1661)

i- He refused the Aristotle concept.

ii-He was the 1st scientist to define the

element as pure simple substance which cannot be analvsed into simple one by normal chemical methods.

4) Dulton s atom (Englsh 1803)
He supposed that:
1- The substance consists of very small particles called atoms.

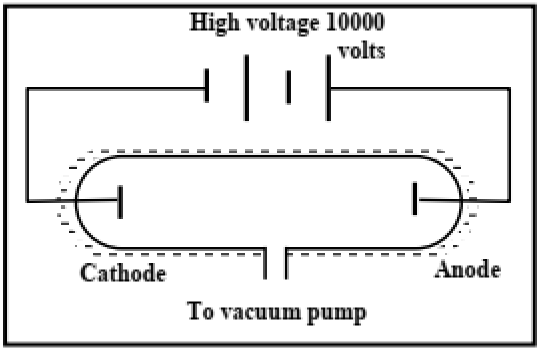
2- Every element consists of very small dense atoms which can'tbe divided.

3- Atoms f the same element are identical.

4- Atom of different are different.

N.B By the 19 th century
Scientists had accepted the idea that elements consists of atoms but they
knew very little about those atoms.

CATHODE- RAVS EXPERIMENT (DISCOVERY OF THE ELECTRON)



a-All gases under normal conditions of pressure and temp (76 cm. hg. 25c) don't conduct electricity.

b-If a glass tube evacuated from the gas to decrease its pressureto reach
0.01.1 ------------ 0.001 m.mhg
the gas will conduct electric current.

c-If the potential difference between the tow poles increases up 10.000 Volts a Flow of invisible rays are emitted from the cathode causing glowing to the wall of tube behind the anode and called cathode ray

PROPERTIES OF CATHODE RAYS

1)Consists of tiny particles have mass and velocity.

2)Transfers in straight lines glowing the glass facing the

cathode.3) Have negative charge.

4)Have a thermal effect.

5)Affected by electric and Magnetic field.

6)Cathode rays don t change by changing either cathode material or type of the gas which proves that cathode rays take part in the structure of all substances.

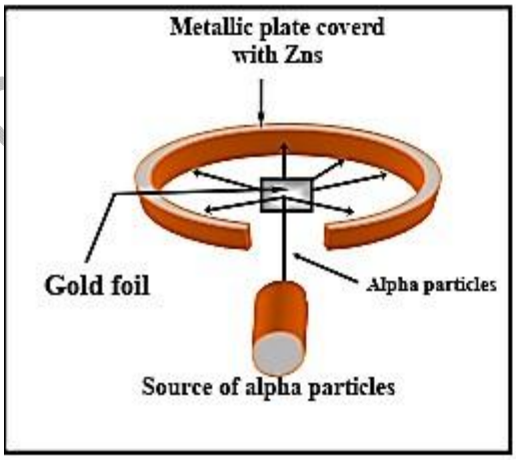
5 - Thomson s atom 1897

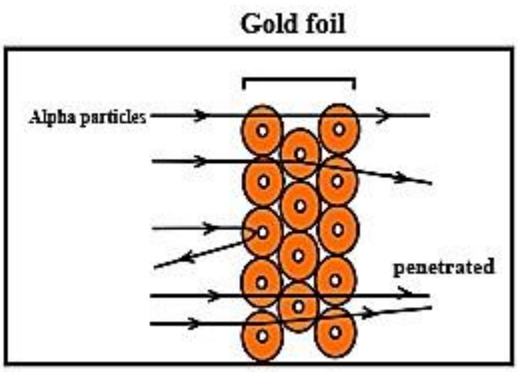
He conclude from the last experiment that
i- The atom is a homogenous sphere of positive electricity.

ii-Inside it there are negative electrons enough to make it electrically neutral.

RUTHER FORD S EXPERIMENT

In 1911 Geiger and Marsden performed a famous exp According to suggestion of Ruther ford by the following apparatus.





1 – He allowed alpha particles to hit a metallic plate lined with Zinc suphide (glows when hits with alpha rays)

2 – On placing a gold foil in the front of alpha rays he concluded the following from the following observation.

Observation	Result
1- Most of alpha particles appeared in the same position before putting gold foil.	**1- Most of the atom is a space not solid as explained by Dalton and Thomson.**
2- A very small percentage of alpha particles reflected back to appears as flashes on other side of sheet.	**2- The atom has very small part with very small volume but high density.**
3- Some flashes appeared on the sides of 1st site.	**3-The dense part of the atom which concentrate in it most mass have same charge of alpha particle (+ve) which called nucleus of the atom.**

Structure of the atom

MASS NO:

Sum of protons and neutrons inside the nucleus.

ISOTOPES:

Are different forms of atoms of the same element which have same atomic no. but different mass no.

Ex: hydrogen has 3 isotopes: ……….

Rutherford:

Rutherford was the 1st scientist who stated the concept of the atomic structure.

1- THE ATOM:

Although it has very small size but it has a complicated structure that resembles the solar system in which electrons revolve around the central nucleus in orbits as planets revolve around the sun.

2-The Nucleus:

Is much smaller than the atom. Located in the centre of the atom with (+ve) charge. There is a big space between the nucleus and orbits of electrons, so most of the atom is a space. Most mass of the atom is concentrated in the nucleus as mass of e is very small and can be neglected.

3- ELECTRONS:

1. Have negligible mass compared to that of the nucleus.
2. No of electrons (-ve) equals no of ptotons (+ve) so the atom is electrically neutral.

3. Electrons revolve around the nucleus in a fixed orbit aselectrons are affected by two forces equal in strengthbut in opposite direction, which are :

1-Force of attraction of the nucleus to electrons.

2-Centrifugal force due to velocity of electron around the nucleus.

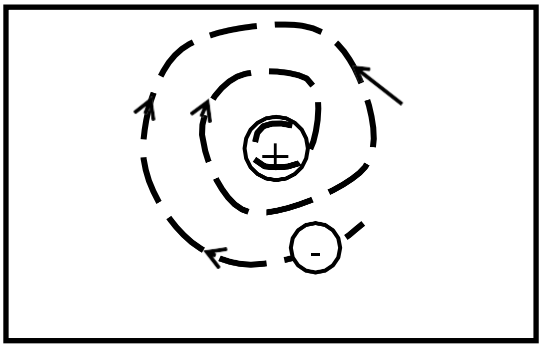
Give reason: Electrons are not attracted to thenucleus.
Explain: Structure of the atom in the view ofrutherford.

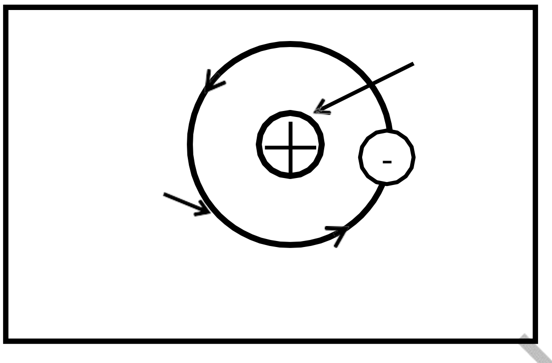
Objections on Rutherford's atomic model (Maxwell's theory):

Rutherford's concept was contradicted by maxwell's theory (Which was based on laws of newton mechanics and concerned with the movement of relatively large bodies).

1 Which states that: “When an electrecally charged body moves in orbit, it will lose its energy gradually by emission of radiation causing gradual decrease in orbit radius".

By applying this theory on electron movement in Rutherford's atom, we would expect that electrons are in a state of continuous emission of radiation, so the atomic radius will decrease and electrons move in a spiral orbit until they hit the nucleus.





GIVE REASON: Contradiction between the classical mechanical laws and rutherford.

Bohr's Atomic Model

Bohr's postulates:

1- A positively charged nucleus exists in thecenter of the atom.
2- Atom is electrically neutral as no of p^+ sequals to no of e's.

3-Electrons revolve around the nucleus in orbits due to centrifugal and attraction forces.

4-Electrons orbit the nucleus in a rapid movement without gaining or losing energy.

5-Electrons orbit the nucleus only in a definite allowed energylevels, so they can't be found at intermediate distance.

6- Each electron in the atom has a definite amount of energy depending on the distance between is E.L and nucleus. This energy increases as its radius increases.

7- It was found that the maximum no of energy levels in the heaviest known atoms in their ground state (unexcited) is only seven (K, L, M, N, O, P, Q). Each level has energy expressed by awhole no called principle Q. No.

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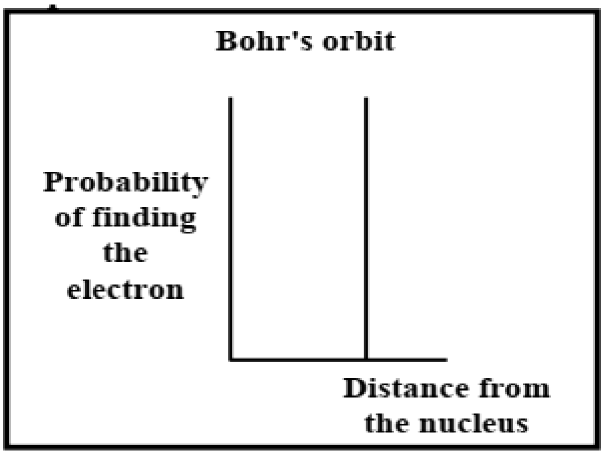
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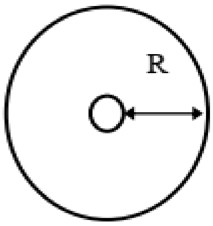
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